FACTORING IN ALGEBRA

Name:_______________________________________ Period:__________

Date:____________________

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1. In the following tables:

- First substitute the choices for x in the given algebraic expression.
- Then calculate the expression values belonging to each choice of x, but wait with the row starting with n.
- After you have done this for each choice of x, decide how to factor the values-column. The rule for this is that you must end up with two columns that each forms a **pattern**. When you choose the factors always write the smaller one first (for example, 3 first and 5 second for the product 15).

The row starting with n asks you to determine what the factors for the algebraic expression are when you would substitute **any number** n for x. You can do this by comparing the pattern for the first factor with the choices in the x-column and write this algebraically. (Notice how the choices in the x-column are also in a pattern.) For example, if the first factors are always 2 more than the choices in the x-column, we would express this relationship as $n+2$. When you have this figured out for the first column, then do the same for the second column.
When you can find the algebraic relationship between the x-column and the two factor columns mathematicians say that they have factored an algebraic expression.

Table 1

x	5x + 10 Substitute	Value	Factored In a pattern	
1	5(1)+10	15	3	5
2				
3				
4				
5				
n				

Complete this table and write the algebraic factorization below:

5n + 10 = ______________________________

Describe how you determined your result using table 1:

2. Continue doing the same for tables 2, 3, 4, and 5.

Table 2

x	$6x - 3$ Substitute	Value	Factored In a pattern	
1	$6(1) - 3$	3		
2				
3				
4				
5				
n				

$6n - 3 =$ ______________________________________

Table 3

x	$x^2 + x$ Substitute	Value	Factored In a pattern	
1	$1^2 - 1$	0		
2				
3				
4				
5				
n				

$n^2 - n =$ ____

Table 4

x	$2x^2 - x$ Substitute	Value	Factored In a pattern	
1	$2(1)^2 - 1$	1		
2				
3				
4				
5				
n				

$2n^2 - n =$ ___________________________________

Table 5

x	$5x^2 + 10x$ Substitute	Value	Factored In a pattern	
1	$5(1)^2 + 10(1)$	15		
2				
3				
4				
5				
n				

$5n^2 + 10n =$ ________________________________

3. Explain in your own words what you have learned about algebraic factoring in the previous five tables. You can use the work in your tables to refer to what you discovered.

4. You probably found that $5x + 10 = (x+2)5$, and that $6x - 3 = (2x-1)3$. Does it matter if we would write this as $5x + 10 = 5(x+2)$, and $6x - 3 = 3(2x-1)$? Why or why not?

5. Mathematicians often prefer to write numbers before variables. Let's agree to work like mathematicians do. Compare tables 1 and 2, with tables 3 and 4. What are the differences and what are the similarities? And what about table 5? How does this one compare to all four previous tables?

6. Try to factor a few expressions without using a table. Only use a table if you are stuck.

$15x + 45 =$ ______________________________

$8 + 16x =$ ______________________________

$4x - 12 =$ ______________________________

$x^2 - x =$ ______________________________

$2x - 3x^2 =$ ______________________________

7. How were you able to factor these expressions without using a table?

8. Let's look at a few more special expressions that mathematicians like to use often. Complete tables 6 and 7. Be careful how you use the negative numbers. Review the rules for adding, subtracting, multiplying, and dividing positive and negative numbers.

Table 6

x	$x^2 - 4$ Substitute	Value	Factored In a pattern	
1	$(1)^2 - 4$	-3		
2				
3				
4				
5				
n				

$n^2 - 4 =$ ______________________________

Table 7

x	$x^2 - 9$ Substitute	Value	Factored In a pattern	
1	$(1)^2 - 9$	-8		
2				
3				
4				
5				
n				

$n^2 - 9 =$ ___________________________________

9. Explain what is special about the results of table 6 and 7. Also write a few more examples of this special kind of expression and their algebraic factorization. Mathematicians call these expressions **differences of two squares**.

10. So far you have been factoring algebraic expressions that have two terms in them. Mathematicians call these sorts of expressions *binomials*. We will now take a look at expressions that have three terms (*trinomials*). Try the following four tables (8-11) for yourself.

Table 8

x	$x^2 + 3x + 2$ Substitute	Value	Factored In a pattern	
1	$(1)^2 + 3(1) + 2$	6		
2				
3				
4				
5				
n				

$n^2 + 3n + 2 =$ ______________________________

Table 9

x	$x^2 + 4x + 3$ Substitute	Value	Factored In a pattern	
1	$(1)^2 + 4(1) + 3$	8		
2				
3				
4				
5				
n				

$n^2 + 4n + 3 =$ ______________________________

Table 10

x	$x^2 + 2x + 1$ Substitute	Value	Factored In a pattern	
1	$(1)^2 + 2(1) + 1$	4		
2				
3				
4				
5				
n				

$n^2 + 2n + 1 =$ ______________________________

Table 11

x	$x^2 + 6x + 9$ Substitute	Value	Factored In a pattern	
1	$(1)^2 + 6(1) + 9$	16		
2				
3				
4				
5				
n				

$n^2 + 6n + 9 =$ ________________________________

11. Compare tables 8, 9, 10, and 11 and explain what you discovered.

12. Try factoring a few more trinomials without using tables. Only use a table when you are stuck.

$x^2 + 5x + 4 =$ ________________________________

$x^2 + 6x + 5 =$ ________________________________

$x^2 + 7x + 6 =$ ________________________________

$x^2 + 4x + 4 =$ ________________________________

$x^2 + 8x + 16 =$ ________________________________

$x^2 + 10x + 25 =$ ________________________________

13. Explain briefly how you factor trinomials without using a table.